

# Working Towards Field Implementation of LF Bioreactors

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# Regulatory Drivers

- ▶ *RD&D rule, proposed June 2002  
40 CFR part 258.*
- ▶ *40 CFR Part 63, NESHAPS Rule, January  
16, 2003*



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# Transition of Policy Impacting the Research

- *Presently few operating sites with outside liquid addition.*
- *Agency focus on Biosolids Safety in land spreading and landfills.*
- *Need for green energy in the United States.*
- *Trading of greenhouse gas emission credits, establishment of CCX.*



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# USEPA/WM CRADA

- ✦ *5 year Cooperative Research & Development Agreement.*
- ✦ *Rigid QA/QC procedures through a QAPP.*
- ✦ *Designed for Statistical Interpretation.*
- ✦ *Four LF Bioreactors, Two Control Subtitle D Cells.*



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# CRADA Project Objectives

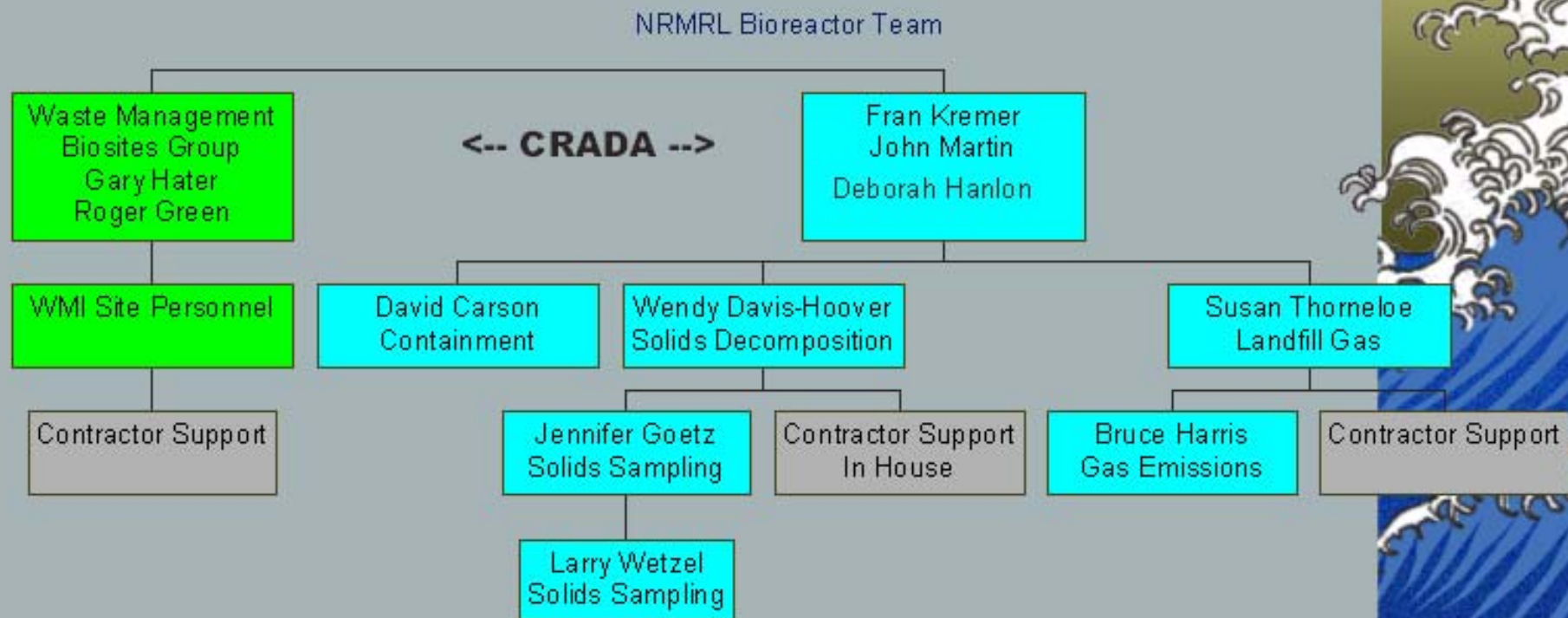
- *To determine the parameters and trends that should be monitored to assess the performance of and control a bioreactor landfill.*
  - *Leachate*
  - *Gas Management/Fugitive Emissions*
  - *Solids Decomposition*
- *Two primary sites*
  - *Area 7 – New fill*
  - *Area 5 – Existing fill to be retrofitted, and will use nitrified leachate to control ammonia levels*
  - *Shared experimental control area*



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# CRADA Team Structure



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# The Site

## GENERAL INFORMATION:

THE SITE CONTAINS 782.15 acres  
 NUMBER OF TRUCKS DELIVERING WASTE TO SITE DAILY - 600-700  
 NUMBER OF MILES OF INTERNAL ROADS - 11.87  
 NUMBER OF VISITORS ANNUALLY - 800  
 NUMBER OF TREES PLANTED - 430 PER AC.  
 COUNTIES PERMITTED IN KENTUCKY TO DISPOSE OF MSW 18  
 COUNTIES PERMITTED IN INDIANA TO DISPOSE OF MSW 4  
 AREA ZONING: M-3 INDUSTRIAL

## MATERIAL ACCEPTED FOR DISPOSAL IN 2001:

TONS OF COG/SOLID WASTE/SPECIAL WASTE - 1,049,869  
 TONS OF NON-HAZARDOUS LIQUID/SLUDGE SOLIDIFIED - 19,793  
 TONS OF COMPOST PROCESSED - 34,993  
 TONS OF PETROLEUM CONTAMINATED SOIL BIOLOGICALLY TREATED - 58,955

## METHANE GAS - 2001:

TOTAL NUMBER OF GAS WELLS - 127  
 NUMBER OF FLARES - 2  
 CUBIC FEET OF GAS GENERATED DAILY - 6,480,000  
 MILLION CUBIC FEET SOLD TO GENERAL ELECTRIC - 1,122,808

## LEACHATE - 2001:

GALLONS OF LEACHATE PRETREATED AND DISCHARGED TO MSD - 35,842,124 GALLONS  
 GALLONS OF NON-HAZARDOUS LIQUID COMMERCIAL WASTE TREATED AT THE SBR AND DISCHARGED TO MSD - 1,498,528 GALLONS

## FLOODPLAIN - 2001:

FLOODPLAIN CONSUMED - 1,458,391 c.y.  
 FLOODPLAIN COMPENSATED - 1,955,618 c.y.

## MONITORING - 2001:

NUMBER OF PERMITTED KPDES POINT CHARGES - 23  
 TOTAL NUMBER OF GROUNDWATER WELLS - 45  
 TOTAL NUMBER OF UNDERDRAINS - 8

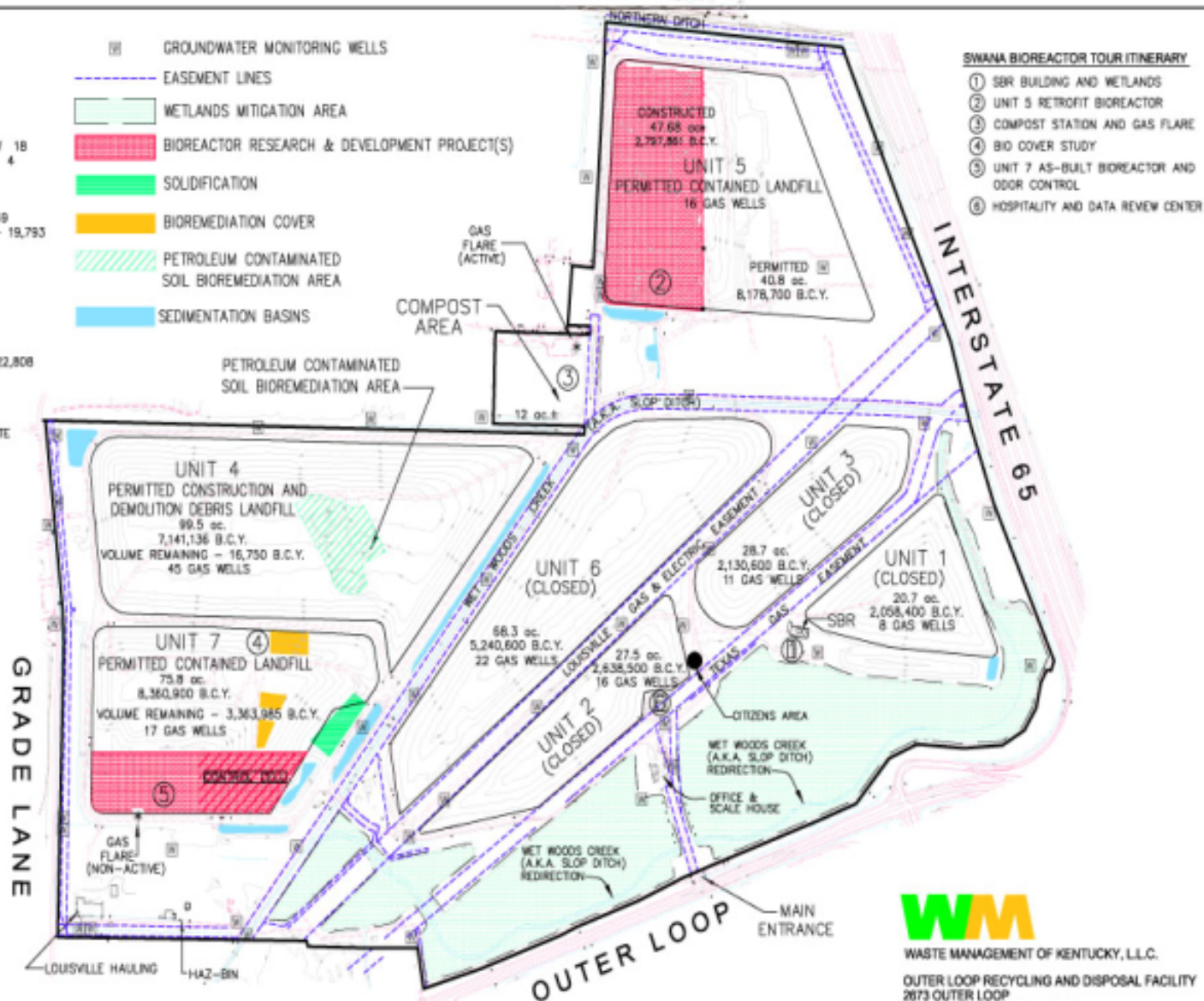
## WETLANDS - 2001:

ON-SITE WETLANDS PERMITTED TO IMPACT - 190 ac.  
 ON-SITE WETLANDS MITIGATION - 135.6 ac.  
 OFF-SITE WETLANDS MITIGATION - SWARTZ.....20.4 ac.  
 BOSTON.....280 ac.  
 HARNED.....43 ac.

## EASEMENTS:

LOUISVILLE GAS & ELECTRIC CO.: 27.8 acres  
 TEXAS GAS TRANSMISSION CO.: 14.8 acres  
 LOUISVILLE WATER CO.: 2.5 acres  
 METROPOLITAN SEWER DISTRICT: SEWER & DRAINAGE.....3.8 acres  
 SEWER.....2.5 acres  
 DRAINAGE.....24.1 acres  
 INGRESS & EGRESS.....0.88 acres  
 BELL SOUTH TELECOM: 0.32 acres  
 INDUSTRIAL PIPELINES: 0.68 acres

- GROUNDWATER MONITORING WELLS
- EASEMENT LINES
- WETLANDS MITIGATION AREA
- BIOREACTOR RESEARCH & DEVELOPMENT PROJECT(S)
- SOLIDIFICATION
- BIOREMEDIATION COVER
- PETROLEUM CONTAMINATED SOIL BIOREMEDIATION AREA
- SEDIMENTATION BASINS



## SWANA BIOREACTOR TOUR ITINERARY:

- ① SBR BUILDING AND WETLANDS
- ② UNIT 5 RETROFIT BIOREACTOR
- ③ COMPOST STATION AND GAS FLARE
- ④ BIO COVER STUDY
- ⑤ UNIT 7 AS-BUILT BIOREACTOR AND ODOR CONTROL
- ⑥ HOSPITALITY AND DATA REVIEW CENTER



WASTE MANAGEMENT OF KENTUCKY, L.L.C.

OUTER LOOP RECYCLING AND DISPOSAL FACILITY  
 2673 OUTER LOOP  
 LOUISVILLE, KENTUCKY 40219  
 (502) 686-0272

May 2002

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# USEPA/WM CRADA

- ▶ *Progress Report is Due out in 2003.*
- ▶ *Conference Publish Rate is >4 /year.*
- ▶ *Additional Sites to be Added in Future.*

## *Unique Features:*

- ▶ *Air Emissions Monitoring.*
- ▶ *Outside Liquid Addition.*
- ▶ *Compost Cover Study.*
- ▶ *High Biosolids Rate.*



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# What Designs to Study?

- ✦ *As Built vs. Retrofit*
- ✦ *Anaerobic*
- ✦ *Facultative*
- ✦ *Aerobic-Anaerobic*
- ✦ *Aerobic*





**Surface Application of Liquids in  
a “as built” System.**





**Deck Watering as Means of  
Adding Moisture.**





**Trenching for a Retrofit**



# Monitoring Philosophy & Key Parameters

## ▲ *Reference USEPA/WM QAPP*

- ▲ *Leachate*
- ▲ *Settlement & Mass*
- ▲ *Gas Production*
- ▲ *Air Emissions*



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# What is the Minimum, for Leachate at New Research Sites

- ✦ *Chemical oxygen demand*
- ✦ *Biochemical oxygen demand*
- ✦ *Temperature*
- ✦ *pH (field)*
- ✦ *Volatile organic acids*



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# What is the Minimum, for the Waste Mass at New Research Sites

- ✦ *Waste temperature*
- ✦ *Waste settlement (GPS)*
- ✦ *Organic solids\**
- ✦ *Moisture content (calculated) \**
- ✦ *pH\**
- ✦ *Biochemical methane potential (BMP) \**

\* *low frequency, based on mass collection during placement and drilling.*



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# What is the Minimum, for Gas at New Research Sites

- ✦ *Methane, field, lab (Summa)*
- ✦ *Carbon dioxide, field, lab (Summa)*
- ✦ *Oxygen, field, lab (Summa)*
- ✦ *Gas volume*
- ✦ *Perhaps, more frequent Surface emission monitoring*



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# Frequency of Sampling

- ✦ *Leachate: monthly – quarterly\**
- ✦ *Mass (GPS): quarterly – 24 months*
- ✦ *Gas: monthly*
- ✦ *Surface Emissions – quarterly*



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# Operational Expertise

- ✦ *Review Bibliography for Industry.*
- ✦ *Review recent Conference Literature.*
- ✦ *Visit Web Sites.*
- ✦ *Call Operating Facilities and ask for Tour of the Facility.*



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# Publications

- ▲ *SWANA*
- ▲ *NSWMA*
- ▲ *LMOP*
- ▲ *Sardinia Proceedings*
- ▲ *USEPA/WM Interim CRADA Document*



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# Web Sites

- ✦ <http://www.bioreactor.org/>
- ✦ <http://www.epa.gov/projectxl/yolo/index>
- ✦ <http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/bioreactors.htm>
- ✦ <http://www.wm.com/bio.asp>



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# Areas of Permit Applicant & Permitting Focus:

- ▶ *Collection of an Operating Record that helps the industry.*
- ▶ *Set up Key Areas of Concerns for Interaction, surface application of liquids, outside liquids, leachate breakout-repair, odors, alternate covers.*



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